The Epidemiology of Back-Related Hospitalizations Among U. S. Navy Personnel

LT Charles V. Chesson II, MSC, USNR
and
Susan M. Hilton, M.A.

Health Psychology Department
Naval Health Research Center
P.O. Box 85122
San Diego, CA 92138-9174

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SUMMARY

In order to provide a baseline for the evaluation of programs to prevent lower back problems in the Navy, the present study investigated the incidence of inpatient back problems of enlisted active-duty Navy personnel during 1974-1983. There were 13,109 individuals with a first hospitalization for a back problem during the decade, and the most frequent diagnosis was Vertebrogenic Pain Syndrome (36.7%). Individuals with Navy service of less than one year, as well as those with over 20 years, were most likely to be hospitalized. The 17-19 age group was the most likely to be hospitalized. Those occupations most likely to be associated with back problems were health care, weapons control, seaman-striker, general seamanship, and master-at-arms. There were 3,377 individuals with back problems who appeared before a medical board and 2,213 who appeared before a physical evaluation board. The two diagnoses that most often led to a medical board or a physical evaluation board were Displacement of Intervertebral Disk and Vertebrogenic Pain Syndrome. The most common disposition of a physical evaluation board was an award of 10% disability (35.9%). The results are discussed in terms of greatest-risk groups and back problem prevention.

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INTRODUCTION

Back problems are the most expensive worker compensation claims in industry (Owen, 1986). Based on 1979 data for 26 states that use the Bureau of Labor statistics supplementary data system, Klein, Jensen, and Sanderson (1984) found that 19.3% of all compensation claims were due to back problems. Males accounted for 76% of all claims, with the largest occurrence in the 20-to-34 age category. Klein, et al. (1984) reported that the average cost for back sprains/strains in 1979 dollars was $3,533, of which $470 were attributable to medical costs, and $3,063 were due to indemnity compensation. The total medical and indemnity compensation costs for the 285,468 back problem cases which occurred in the 26 states exceeded one billion 1979 dollars. Those individuals found to be at greater risk for back problems were (1) young inexperienced workers, (2) obese individuals, (3) those suffering from chronic stress, (4) those with poor back-muscle strength, (5) those limited in their flexibility as tested by both the finger-tip-to-floor distance when bending at the waist and the capacity to do a sit-up, (6) those found to be in poor physical condition as measured by running performance, and (7) those whose job was basically sedentary (i.e., the supervisor may be at greater risk for a back problem than the supervised employee whose job entails constant lifting)(Biering-Sorensen, 1984; Karvonen, Viitasalo, Komi, Nummi, & Jarvinen, 1980; Klein, et al. 1984; Locke, 1983; Pedersen, 1981; and Shephard, 1974).

Four of the basic back problem prevention strategies practiced in industry involve (1) screening of applicants, (2) educational programs, (3) ergonomics, and (4) fitness training. Screening of applicants for present back problems or susceptibility to back problems is problematic because there is little that can be determined with a cursory examination, a more rigorous examination is not cost effective, and any such exam could subject the company to expensive discrimination lawsuits (Troup, 1984). Radiographic screening is

also legally questionable, considering the lack of medical evidence to support its screening value, and the safety issue of radiation exposure.

Educational programs tend to focus on safety and proper lifting procedures. Delimiters associated with such educational programs include (1) little scientific evidence to support their effectiveness (Brown, 1975; Locke, 1983; Owen, 1986), (2) difficulties in getting people to put the recommendations into practice, and (3) high risk of injury among personnel in poor physical condition even if proper lifting techniques are used.

Ergonomics as a back problem prevention strategy is concerned with redesigning the work place and/or task to reduce the likelihood of back problems (Troup, 1984). One common ergonomically sound redesign is to reduce the weight or size of the packaging (Yu, Roht, Wise, Kilian, & Weir, 1984). A major problem with implementing ergonomic redesign is that it can require major overhauls of existing systems, which is expensive and time consuming (Troup, 1984). Ideally, ergonomic design is implemented at inception. Another problem with ergonomic design is its limited applicability to off-the-job injuries, which are very prevalent and are often aggravated by the job (Owen, 1986), which may prompt the worker to then claim workman's compensation. Clearly, preventive measures that are not easily applicable in the home environment will have only limited effectiveness against off-the-job injuries.

The implementation of physical fitness programs in the work place is the most recent trend toward back problem prevention in industry (Locke, 1983; Owen, 1986). Evidence that as much as 90% of all back problems are due to muscle insufficiency (Locke, 1983) has stimulated much of this new emphasis on physical fitness. The two components of muscle insufficiency are strength and flexibility. Strength is indicated by the contractual power of the muscles; flexibility refers to their elasticity. A minimal measure of strength is one sit-up with straight legs, as well as a sit-up with legs bent and secured at the ankles. A measure of hip flexor muscle strength, also related to back strength, is 10 seconds of holding the feet 10 inches from the floor while lying with hands behind the head, legs straight. An appropriate measure of back flexibility is to touch one's toes without straining. In a study of firefighters over a three-year period, Cady, Bischoff, O'Connell, Thomas, and

Allan (1979) found that those firefighters most fit experienced only 10% of the back problems. Further, the most fit firefighters who were injured recovered more quickly than others. Superko, Bernauer, and Voss (1983) found that after an 18-month fitness program with the California police, back dysfunction decreased from .61% to .13% of the work force. A very positive factor associated with physical fitness training is that the improved physical fitness also prevents off-the-job back problems.

As one aspect of an overall health promotion program, the Navy has introduced a program to prevent back problems (Chief of Naval Operations OPNAVINST 6110.1C, 1986). The Navy's back problem prevention program consists of a physical fitness program for improving muscular sufficiency (via sit-ups for back strength, and sit-reach for flexibility), and an educational program. A necessary step toward evaluating the effectiveness of a well-back program is to measure the pre-implementation extent of the problem. The focus of this paper was to describe the incidence, prevalence, and disposition of inpatient back problems of Navy enlisted active duty personnel during the 10 years preceding the implementation of the Health and Physical Readiness Program. One aspect of disposition of the back problem is whether or not the individual appeared before a medical board or a physical evaluation board. Medical board and physical evaluation board data were examined, including the dispositions of the boards' action.

METHODS

The data, and documentation on the data codes, were supplied by the Occupational Medicine Department, Naval Health Research Center. These data were extracted from their Navy Enlisted Career/Medical History File containing records of all active duty, enlisted, Navy personnel (Garland, et al., 1987). Record selection was determined by incidence of back problem hospitalization between 1974 and 1983, inclusive. For each record, data were selected pertaining to the hospitalization, demographics, first accession, latest medical board, latest physical evaluation board, latest career event, and the duty station prior to hospitalization. Regrouping of rate information into occupational categories was based on groupings presented in Bluejacket's Manual (Bearden and Wedertz, 1978). Percent of expected was calculated by dividing the rate per 10,000 for the group by the rate per 10,000 for the entire Navy. In order to compute first-hospitalization rate, Navy total

person years were computed by summing the personnel per category per year over all ten years. Those figures were obtained via computer programs specially developed at the Naval Health Research Center to calculate person years for specified time spans (Garland, et al., 1987).

RESULTS

There were 13,109 active duty, enlisted, Navy personnel whose first hospitalization involved a back problem as the primary diagnosis during the decade of 1974-1983. A demographic summary of these patients is presented in Table 1. In addition to the 13,109 hospitalizations, there were 1,871 individuals whose first hospitalization involved a back problem that was not the primary diagnosis. These 1,871 people were later hospitalized with a back problem as the primary diagnoses. The 14,980 back-problem cases were hospitalized a total of 16,924 times, representing 3% of all active-duty Navy personnel hospitalizations over the 10-year period. The most frequent back-problem diagnosis for first hospitalization was Vertebrogenic Pain Syndrome (36.7%) (see Table 2). Other leading diagnoses included Displacement of Intervertebral Disk (17.8%), Sprain/Strain of Other or Unspecified Back Part (17.6%), Sprain/Strain Sacroiliac Joint (12.5%), and Fracture/Fracture-Dislocation of Vertebral Column Without Spinal Cord Lesion (12.0%).

Table 1

Demographic Summary of Navy Active Duty Enlisted Personnel Hospitalized During 1974-1983 with Back Problem as the Primary Diagnosis at First Hospitalization

Sample Size:	13,109	Paygrade:	
		E-1:	12.6%
Sex:		E-2:	11.3%
Male:	92.9%	E-3:	18.6%
Female:	7.1%	E-4:	16.0%
	100.0%	E-5:	15.7%
		E-6:	15.6%
Race:		E-7:	7.0%
Caucasian:	88.2%	E-8:	2.3%
Black:	8.8%	E-9:	.9%
Other:	3.0%		100.0%
	100.0%		
Average Age:	25.7 (Range 17-59)		

Table 2

Distribution of Back-Problem Primary Diagnoses Associated with First Hospitalization

Diagnostic Category	N	%
Vertebrogenic Pain Syndrome	4,809	36.7
Displacement of Intervertebral Disk	2,329	17.8
Sprain/Strain of Other or Unspecified Back Part	2,302	17.6
Sprain/Strain Sacroiliac Joint	1,636	12.5
Fracture/Fracture-Dislocation of Vertebral Column Without Spinal Cord Lesion	1,575	12.0
Affection of Sacroiliac Joint	197	1.5
Fracture/Fracture-Dislocation of Vertebral Column With Spinal Cord Lesion	115	.9
Open Back Wound	91	.7
Spinal Cord Lesion Without Evidence of Spinal Bone Injury	55	.4
Total	13,109	100.0

Table 3 displays the relationship between year and number of hospitalizations for a back problem. Although the number of back problems decreased across the years ($\underline{r}(10) = -.89$, $p<.01$), this is consistent with a decreasing overall hospitalization rate throughout the Navy ($\underline{r}(10) = -.82$, $p<.01$) and does not represent an independent effect.

Table 3

Number Of Back-Related and Overall Hospitalizations by Year for Navy Active Duty Enlisted Personnel

Year	Back-Related Hospitalizations	All Hospitalizations
1974	1,738	63,274
1975	1,420	61,398
1976	1,516	60,558
1977	1,614	62,015
1978	1,426	56,015
1979	1,181	54,083
1980	1,070	50,954
1981	1,032	59,026
1982	1,003	49,833
1983	1,109	52,733
Total	13,109	569,889

Those individuals whose length of service (LOS) at the time of their first back-problem hospitalization was less than one year or 20 years or more had the highest back problem hospitalization rates (Table 4). As shown in Table 5, individuals in the 17-to-19 age group were most likely to be hospitalized for a back problem.

Table 4

Back Related Hospitalizations (1974-1983) by Length of Service (LOS)

LOS Category (Years)	First Hospitalization N	Population Person Years	Rate Per 10,000*	Percent of Expected
<1	2,932	799,251	37	132
1	2,017	738,983	27	96
2	1,538	638,179	24	86
3	1,124	511,252	22	79
4	554	274,239	20	71
5-7	1,190	536,439	22	79
8-10	822	318,196	26	93
11-19	2,322	733,175	32	114
20+	610	126,546	48	171
Total	13,109	4,676,260	28	100

$$*\text{Rate} = \frac{\#\ \text{Hospitalized}}{\text{Navy Person Years from '74-'83}} \times 10{,}000$$

Table 5

Back Related Hospitalizations (1974-1983) by Age Category

Age Category (Years)	First Hospitalization N	Population Person Years	Rate Per 10,000*	Percent of Expected
17-19	2,489	303,129	82	241
20-29	6,957	2,524,079	28	82
30-39	3,081	882,680	35	103
40-49	549	146,732	37	109
50+	31	20,449	15	44
Total	13,107	3,877,069	34	100

$$*\text{Rate} = \frac{\#\ \text{Hospitalized}}{\text{Navy Person Years from '74-'83}} \times 10{,}000$$

Navy enlisted personnel who were occupationally involved in health care were at greatest risk for back problems, with 162% of expected hospitalizations (Table 6). Following health care, the categories of weapons control, seaman-striker, general seamanship, and master-at-arms had the highest hospitalization rates. Those three occupations with the lowest hospitalization rate for back problems were intelligence, cryptology, and weapons system support.

Table 6

First Hospital Admission Rates for 28 Occupational Categories for the 1974-1983 Decade

Occupational Category	First Admission N	Population Person Years	Rate/10,000 Person Years*	Percent of Expected
Health Care	1,234	262,554	47	162
Weapons Control	463	110,238	42	145
Seaman-Striker	2,398	599,500	40	138
General Seamanship	461	118,205	39	134
Master-At-Arms	34	8,947	38	131
Air Traffic Control	81	25,312	32	110
Construction	342	106,875	32	110
Construction-Striker	29	9,355	31	107
Ship Maintenance	426	146,897	29	100
Aviation Maintenance	1,690	582,759	29	100
Aviation Ground Support	248	85,517	29	100
Airman-Striker	598	206,207	29	100
Ship Operations	311	119,615	26	90
Marine Engineering	1,627	625,769	26	90
Ordinance Systems	343	131,923	26	90
Aviation Sensor Operations	70	29,167	24	83
Administration	473	215,000	22	76
Logistics	805	365,909	22	76
Media	80	36,364	22	76
Musician	20	9,091	22	76
Fireman-Striker	447	203,182	22	76
Sensor Operations	191	100,526	19	65
Communications	309	162,632	19	65
Meteorology	32	16,842	19	65
Data Systems	103	57,222	18	62
Weapons System Support	29	19,333	15	52
Cryptology	133	88,667	15	52
Intelligence	22	22,000	10	34
Total	12,999	4,465,608	29	100

$$*\text{Rate} = \frac{\#\ \text{Hospitalized}}{\text{Navy Person Years from '74-'83}} \times 10{,}000$$

Note. Ratings grouped in each occupational category are presented in Appendix A. There were 110 people missing occupational data.

To examine the rate of hospital utilization for each occupational group, the number of days of hospitalization per 100 person years for each occupational group was calculated. As shown in Table 7, weapons control, construction-striker, and health care ranked highest. Intelligence and cryptology, on the other hand, had the lowest number of hospital days per 100 person years of the 28 occupational groups.

Table 7

Days of Hospitalization for 28 Occupational Categories for the 1974-1983 Decade

Occupational Category	Days of Hospitalization	Population Person Years	Hospital Days/100 Person Years*	Percent of Expected
Weapons Control	10,682	110,238	9.69	177
Construction-Striker	791	9,355	8.45	155
Health Care	21,501	262,554	8.19	150
General Seamanship	8,210	118,205	6.95	127
Construction	7,394	106,875	6.92	127
Ship Maintenance	8,673	146,897	5.90	108
Aviation Maintenance	33,634	582,759	5.77	106
Marine Engineering	35,558	625,769	5.68	104
Ship Operations	6,705	119,615	5.60	103
Seaman-Striker	33,418	599,500	5.57	102
Musician	494	9,091	5.43	99
Airman-striker	11,105	206,207	5.38	98
Fireman-Striker	9,854	203,182	4.85	89
Aviation Ground Support	4,144	85,517	4.85	89
Ordnance Systems	6,394	131,923	4.85	89
Media	1,646	36,364	4.53	83
Air Traffic Control	1,140	25,312	4.50	82
Master-At-Arms	401	8,947	4.48	82
Weapons System Support	838	19,333	4.33	79
Logistics	15,493	365,909	4.23	77
Administration	8,912	215,000	4.14	76
Data Systems	2,357	57,222	4.12	75
Aviation Sensor Operations	1,161	29,167	3.98	73
Communications	6,422	162,632	3.95	72
Sensor Operations	3,611	100,526	3.59	66
Meteorology	541	16,842	3.21	59
Cryptology	2,428	88,667	2.74	50
Intelligence	466	22,000	2.12	39
Total	243,973	4,465,608	5.46	100

$$\text{*Days/Person Years} = \frac{\text{\# Hospitalized}}{\text{Navy Person Years from '74-'83}} \times 100$$

Data from medical boards and physical evaluation boards were examined to further explore the disposition of those hospitalized for back problems. An analysis of medical board data indicated that Displacement of Intervertebral

Disk (36.5%), Vertebrogenic Pain Syndrome (30.4%), and Fracture/Fracture-Dislocation of Vertebral Column Without Spinal Cord Lesion (17.2%) were the most frequent diagnoses related to medical boards (Table 8). As shown in Table 9, most individuals appearing before the medical board for a back problem were referred to a physical evaluation board (30.1%), returned to limited duty (29.2%), or returned to full duty (28.2%). Vertebrogenic Pain Syndrome (33.7%) and Displacement of Intervertebral Disk (32.4%) were the two leading diagnoses related to physical evaluation boards (Table 10). The most likely dispositions of the physical evaluation boards were 10% disability awarded (35.9%), found fit for duty (24.8%), and 20% disability awarded (21.2%) (Table 11).

Table 8

Distribution of Back Diagnoses Associated with a Medical Board

Diagnostic Category	N	%
Displacement of Intervertebral Disk	1,234	36.5
Vertebrogenic Pain Syndrome	1,027	30.4
Fracture/Fracture-Dislocation of Vertebral Column Without Spinal Cord Lesion	581	17.2
Sprain/Strain Sacroiliac Joint	162	4.8
Sprain/Strain of Other or Unspecified Back Part	152	4.5
Affection of Sacroiliac Joint	148	4.4
Fracture/Fracture-Dislocation of Vertebral Column With Spinal Cord Lesion	57	1.7
Spinal Cord Lesion Without Evidence of Spinal Bone Injury	14	.5
Open Back Wound	2	.0
Total	3,377	100.0

Table 9

Distribution of Medical Board Dispositions for Back Problem Cases

Disposition	N	%
Referred to Physical Evaluation Board	1,016	30.1
Returned to Limited Duty (First period)	985	29.2
Returned to Full Duty	953	28.2
Discharged, Enlisted in Error	230	6.8
Discharged, Physical Disability	115	3.4
Departmental Review or Other	49	1.5
Returned to Limited Duty (Second period)	17	.5
Discharged, Unsuitable for Service	10	.3
Discharged, Convenience of the Government	1	.0
(insufficient data)	1	.0
Total	3,377	100.0

Table 10

Distribution of *Back Diagnoses Associated with a* Physical Evaluation Board

Diagnostic Category	N	%
Vertebrogenic Pain Syndrome	746	33.7
Displacement of Intervertebral Disk	718	32.4
Fracture/Fracture-Dislocation of Vertebral Column Without Spinal Cord Lesion	321	14.5
Fracture/Fracture-Dislocation of Vertebral Column With Spinal Cord Lesion	124	5.6
Affection of Sacroiliac Joint	109	4.9
Sprain/Strain Sacroiliac Joint	100	4.5
Sprain/Strain of Other or Unspecified Back Part	83	3.8
Spinal Cord Lesion Without Evidence of Spinal Bone Injury	11	.5
Open Back Wound	1	.1
Total	2,213	100.0

Table 11

Distribution of Physical Evaluation Board Dispositions for Back Problem Cases

Disposition	N	%
10% Disability Awarded	795	35.9
20% Disability Awarded	468	21.2
30% Disability Awarded	48	2.2
40% Disability Awarded	77	3.5
50% Disability Awarded	27	1.2
60% Disability Awarded	24	1.1
70% Disability Awarded	7	.3
80% Disability Awarded	7	.3
90% Disability Awarded	2	.1
100% Disability Awarded	98	4.4
Fit For Duty	549	24.8
Limited Duty	35	1.6
Discharged Without Benefits (EPTES)*	34	1.5
Discharged Without Benefits (other)	29	1.3
Referred to Physical Disability Review Board	11	.5
(Death)	2	.1
Total	2,213	100.0

* Existed Prior To Entry in the Service

CONCLUSIONS

Muscular and some exoskelotal back problems appear to be treatable or preventable from the standpoint of a physical fitness training program (Locke, 1983, and Owen, 1986). There are four diagnoses presented herein which would most likely benefit from a physical fitness training program, which are Vertebrogenic Pain Syndrome, Sprain/Strain of Other or Unspecified Back Part, Sprain/Strain Sacroiliac Joint, and Affection of Sacroiliac Joint. These four back problems comprise 68.3% or 8,944 of the back problems over the 10-year period. These same four diagnoses represent 44.1% or 1,489 of the medical boards and 46.9% or 1,038 of the physical evaluation boards over the 10-year period.

Occupations at greatest risk for back problems were health care, weapons control, seaman-strikers, general seamanship, and master-at-arms. It should be noted, however, that the data did not allow comparison of hospital and dental strikers separate from non-strikers in health care. The correspondingly large number of young people in the health care group may have contributed to the relatively high rate of hospitalization. Many of the lower

risk occupational groups are desk jobs (e.g., cryptology and intelligence), whereas many of the high risk occupational groups require physical labor (e.g., health care, weapons control, and seaman-striker).

The 17-to-19-year-old worker who had been on the job less than one year was at greatest risk for back problems. The high rate of hospitalizations for those with an LOS of less than one year indicates back problems were occurring soon after arrival at their first job. This supports the view that it is the young inexperienced worker who is at greatest risk for a back problem (Klein, et al. 1984), and prompts the conclusion that a well-back program should begin in boot camp. The data also showed that the older worker with 20 or more years of service was at increased risk for back problems. Increased physical fitness should reduce back problems among the older workers.

Future plans in this area of research should include attempts to (1) determine actual costs of inpatient back care, (2) quantify the number of outpatient visits, and (3) conduct a prospective study of the relationship between physical readiness test scores and subsequent back problems.

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Appendix A

Ratings Grouped in Occupational Categories

Administration: LN, NC, PN, PC, YN, RP

Air Traffic Control: AC

Airman-Striker: AR, AA, AN

Aviation Ground Support: AB, ABE, ABF, ABH, AF, AS, ASE, ASH, ASM

Aviation Maintenance/Weapons: PR, AV, AX, AE, AT, AQ, AD, AZ, AO, AM, AME, AMH, AMS, ADR, ADJ

Aviation Sensor Operations: AW

Communications: RM

Construction: BU, CE, CM, CU, EA, EO, SW, UT

Construction-Striker: CR, CA, CN

Cryptology: CTA, CTI, CTM, CTO, CTR, CTT

Data Systems: DP, DS

Fireman-Striker: FR, FA, FN

General Seamanship: BM, SM

Health Care: DR, DA, DN, DT, HR, HA, HN, HM

Intelligence: IS

Logistics: AK, DK, EQ, MS, SH, SK

Marine Engineering: BR, BT, EM, EN, GS, GSE, GSM, IC, MM

Master-at-Arms: MA

Media: DM, JO, LI, PH, PI

Meteorology: AG

Musician: MU

Ordnance Systems: GM, GMG, GMM, GMT, MN, MT, TM

Seaman-Striker: SR, SA, SN

Sensor Operations: EW, OT, ST, STG, STS, OTA, OTM

Ship Maintenance/Weapons: HT, IM, MR, ML, OM, PM

Ship Operations: OS, QM

Weapons Control: ET, FT, FTB, FTG, FTM, ETN, ETR

Weapons System Support: TD

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19. ABSTRACT (Continue on reverse if necessary and identify by block number)

In order to provide a baseline for the evaluation of programs to prevent lower . problems in the Navy, the present study investigated the incidence of inpatient bac problems for enlisted active-duty Navy personnel during 1974-1983. There were 13,109 individuals with a first hospitalization for a back problem during the decade, and the most frequent diagnosis was Vertebrogenic Pain Syndrome (30.7%). Individuals with Navy service of less than one year, as well as those with over 20 years, were most likely to be hospitalized. The 17-19 age group was the most likely to be hospitalized. Those occupations most likely to be associated with back problems were health care, weapons control, seaman-striker, general seamanship, and master-at-arms. There were 3,377 individuals with back problems who appeared before a medical board and 2,213 who appeared before a physical evaluation board. The two diagnoses that most often led to a medical board or a physical evaluation board were Displacement of Intervertebral Disk and Vertebrogenic Pain Syndrome. The most common disposition of a physical evaluation board was an award of 10% disability (35.9%). The results are discussed in terms of greatest-risk groups and back problem prevention. (SIC)

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